

Article

Community Forestry for Livelihoods: Benefiting from Myanmar's Mangroves

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Abstract: It is well known that in many rural communities in the developing world, forests, particularly those under community management, are important for people's livelihoods. However, studies on the contribution of forests to the income of different households within a community are rare, including the poorest households and how non-members of the community forestry user group (CFUG) benefit from those resources. This paper compares livelihood strategies and the use of a mangrove CF by different community members in Myanmar. Utilizing a livelihoods approach, data were collected through a household survey ($n = 110$) and various participatory tools. The significance of CF for people's livelihoods was clearly demonstrated, with as many as 91% of households depending on CF products to varying degrees. Livelihood strategies are largely determined by financial assets and road access. Strategies include large levels of dependence on natural resources such as homegardens and CF. Substantial differences were found for CF's contribution to total income depending on CF membership ($p = 0.004$) and wealth ($p = 0.022$). Non-members benefit mostly through subsistence products. The poorest households were found to get the highest income shares (36%) from CF. This leads to the conclusion that with an inclusive process to membership, CF has the potential to reduce poverty.

Keywords: community forestry; livelihoods; mangroves; membership; Myanmar

1. Introduction

Forest resources often contribute substantially to the well-being of rural communities in many developing countries, in particular to the poorest households and especially during times of hardship [1–3]. While the contribution of environmental products and services to rural livelihoods is widely documented [4,5], their significance within forest-dependent communities remains insufficiently explored [6].

In recent decades, the increased recognition of the importance of forests for rural communities, and their record in managing these forests sustainably, especially compared to state forest management, has resulted in the emergence of community forestry (CF). Areas under CF have been increasing throughout the Asia-Pacific, particularly in China, Nepal, the Philippines and Vietnam [7], but also in other countries in the region, though at a slower pace. For example, in 2001, the government in Myanmar set a target of 919,000 ha under CF management by 2030. As of 2016, 12% of the target had been achieved [8].

With its significant natural resources and diverse ecosystems across a land surface area of 68 million ha [9], Myanmar used to be a comparatively well-off country in Southeast Asia, including being viewed as the rice bowl of the region. However, particularly in the fertile region of the Ayeyarwady Delta, this came at the cost of its forests. It was found that between 2002 and 2014,

intact forest decreased by 22.5% [10]. Mangrove forests have particularly suffered, with one study observing a decrease of 64% in the Delta's mangrove cover between 1978 and 2011, attributing this mainly to agricultural expansion [11]. Another important driver, since 1972, was fuelwood collection for charcoal production [12]. The impact of the mangrove loss was particularly felt in 2008, when Cyclone Nargis struck the country, taking the lives of an estimated 140,000 people, killing livestock and damaging paddy fields in the long term. The cyclone was particularly destructive in the Ayeyarwady Delta [13].

Keeping in mind the protective function of mangrove forests [14–16], the Forest Department with the assistance of non-governmental organizations (NGOs) responded by increasing their reforestation efforts along Myanmar's coast. In order to ensure the support of the local communities, plantation establishment was coupled with community forest management plans, as outlined in the Community Forestry Instruction (CFI) [17]. As of 2017, there were 3840 community forestry user groups (CFUGs) in the country [18].

Though CF is widely viewed as having great potential to address poverty and support sustainable livelihood development for forest-dependent peoples, there are also contrasting opinions on whether it tangibly benefits the poorest within a community [19–22].

The mangrove plantations in Myanmar's Delta are a good example of how local people are expected to manage and benefit from CF. However, until now, the impact of such mangrove community forests in Myanmar on the well-being of local households has not been investigated, although studies in other Asian countries show the importance of mangroves for livelihoods [23–25]. Previous studies on community forestry and livelihoods focus on the community members who are directly involved in the CF management. Yet, considering the fact that people living in the vicinity of forests have used them in one way or another since the beginning of civilization, it would be arbitrary to believe that only members of the formally-registered CFUG use them actively. Rather, it could be assumed that the majority of households benefit from the mangroves at least for subsistence purposes. Another study described such evidence of subsistence and small-market uses of mangroves in Cambodia, Colombia, Fiji, Sri Lanka and Venezuela [26]. However, it does not refer to mangrove utilization of different members within a community.

This paper aims to address this gap in the scientific literature by comparing the use of community forests by members and non-members of a CFUG in Myanmar's delta area. It investigates the criteria on which households base their livelihood strategies and assesses the differences between CFUG members and non-members regarding mangrove utilization. Findings will support decision-making in the development of CF in Myanmar and beyond, based on the gained knowledge of different member households within rural communities, their characteristics, CF membership status and their use of community forests. Specifically, the following questions will be examined: (a) Which livelihood strategies do different households within the communities have? What are their characteristics? (b) How are the CFUGs organized? (c) What are the main differences between CF members and non-members? (d) Does CF membership and wealth influence forest use?

2. Materials and Methods

2.1. Study Area

The low-lying Ayeyarwady Delta in southwest Myanmar is strongly influenced by numerous hydrological factors. The first factor is freshwater, which flows from different river systems towards the Andaman Sea. The second involves tides carrying saline water from the sea. Roughly three ecological zones can be distinguished: the saline water zone, the brackish water zone and the fresh water zone. There is a distinct wet season between May and October, when almost all of the annual rainfall (1867 mm) occurs [27]. During the rainy season, many areas experience temporary flooding.

The main income for people in the Ayeyarwady Delta used to be from forest and agriculture [28]. Nowadays, the main income sources in the lower Delta are casual labor (70%), employed farm work

(12%), farming (11%) and fishing (11%), with additional income generation from the sale of poles, seeds and fuelwood sourced from mangroves [29]. For this study, the focus is on the brackish water zone, where most people rely on mangrove community forests for their livelihood and, to a lesser extent, on the above-mentioned activities. Unfortunately, there are no livelihood statistics for the lower Delta.

The forests in the study area have been mostly cleared or heavily degraded in recent years. Only since around 2000 have reforestation efforts increased the mangrove area. Nowadays, practically all forests in the area are mangrove plantations under community management.

Four study villages in the southern part of Pyapon Township were chosen according to three criteria—presence of a CF; accessibility; availability of baseline data—and with the aim to select communities with a range of site conditions. The characteristics of the selected villages are described in Table 1. Two of the villages (B,D) are situated directly along the main road, while the other two (A,C) are more remote.

Table 1. Characteristics of the study villages (CFUG = community forestry user group, hh = households).

	A	B	C	D
Population (No. of hh)	97	199	93	334
CFUG (No. of member hh)	43	50	40	74
CF area (ha)	124	120	140	150
CF since (y)	2001	2001	2001	2003
CF certificate (yes/no)	Yes	Yes	Yes	No

2.2. Framework

The sustainable livelihoods approach (SLA) [30] was chosen as the overall framework for the research as it puts people at the center and assesses complex decisions and livelihood strategies of the households (Figure 1). While livelihood is the sum of household assets and activities [31], livelihood strategy in this study is considered the sum of activities contributing to household income plus additional subsistence activities.

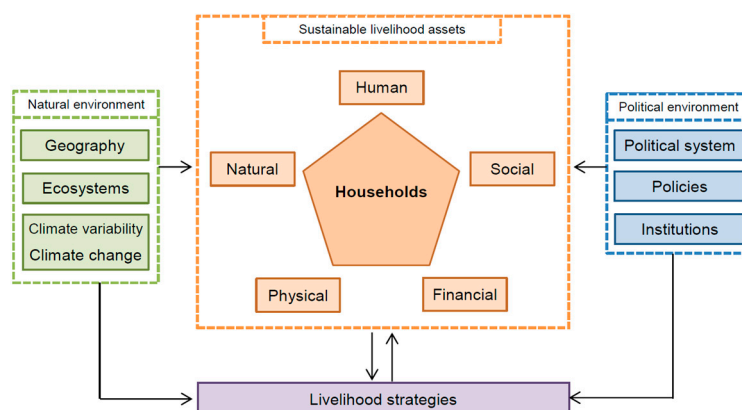


Figure 1. Sustainable livelihoods framework (adapted from [30]).

A livelihoods perspective is crucial for this research, as it includes not only income-generating activities, but also subsistence use of resources. This is of particular importance for natural resources, which are seen as common goods, such as community forests. Some advocate an analysis of forest products use in relation to different livelihood strategies [32,33], and the SLA helps to address this through consideration of the natural and political environment, which both highly influence the study area and people's land use decisions.

2.3. Methods

The research followed various steps. Background reading was conducted to provide a foundational understanding on local livelihoods and the relevance of mangroves and community forests. Additional information was collected during preliminary discussions with diverse stakeholders in-country and on site.

Fieldwork was conducted during five weeks in the study villages. It was divided into two parts to combine qualitative with quantitative information. Qualitative data were collected by means of various participatory research tools [34,35]. They include transect walks, key informant interviews, unstructured informal interviews, resource mapping, historical mapping, seasonal calendar, wealth ranking and several focus group discussions in each village. The key informants were village leaders, village elders, CF chairmen, teachers and staff from different local NGOs and the Forest Department. As many social groups as possible were represented, involving the criteria of gender, age, ethnicity, livelihood activities and CF membership. All of the previously-mentioned tools were applied in each of the four villages and produced comparable results. Data triangulation was ensured through the combination of tools and cross-checking of information. Qualitative information was then backed up with a survey using a standardized and pre-tested questionnaire, which provided quantitative household data. The survey was carried out through face-to-face interviews with a total of 110 households (25 in the smaller two and 30 in the larger two villages). All participants were randomly selected from a list of households provided by the village leaders. Out of the 110 households, 50 were CFUG members. Households are regarded as a unit in the study area. Even though the men usually do the physical work in the CF, women are involved in management decisions and often accompany their husbands to the forest. They both have knowledge about their livelihood activities. The women take the role as household head in cases where the husband is deceased or away for seasonal work. The interviews were held either with the husband, wife or eldest son or daughter.

The field research was conducted jointly with local research assistants, who were previously trained in forest ecology and management and know the context in the study villages and the communities personally.

A results-sharing workshop, as part of a regular multi-stakeholder Community Forestry National Working Group meeting, was held at the end of the data collection period with participants from national research institutes, the Forest Department, different civil society organizations and village representatives. The preliminary results were discussed, and feedback from the stakeholders was included in the analysis.

Qualitative data from interviews and focus groups were interpreted through a content analysis. Quantitative data from the survey were put in an Excel file, and some of the categorical variables were revised in order to reduce the number of categories for interpretation. Due to some missing values, the sample size for analysis varied between 100 and 110. Data were analyzed using the statistical program R (v3.4.1. R Foundation for Statistical Computing, Vienna, Austria) for descriptive statistics and statistical tests. Permutation *F*-tests were chosen due to the zero-inflation of the data. All graphs were produced with the R software.

3. Results

3.1. Livelihood Strategies and Household Characteristics

According to the SLA framework, livelihood strategies are highly influenced by the households' assets. Many of those assets are similar for all community members in the study area. Human assets are rather low due to low level of education (the average adult left school at the age of 10–11) and limited health care. Social assets include good networks within and between communities, mainly inclusive decision-making processes (83% of households participate in village meetings), but often a lack of strong leadership. Physical assets in all villages are limited, i.e., no connection to the electricity grid, limited phone coverage and internet connection and very basic infrastructure. Regarding physical

assets, however, the government has recently shown strong commitments to improve the situation in the Ayeyarwady Delta. While financial assets are generally low, more opportunities have come up recently with microfinance institutions (59% of households have already used it). Natural assets consist of the community forests, farmland and homegarden land. Although people can make use of the land, no formal land titles are given except for the CF.

The study revealed various livelihood systems in the study sites. They usually consist of different combinations of one or more income-generating activity. Nonetheless, four main household strategies can be distinguished (summarized in Table 2). They can be characterized according to the corresponding main livelihood activity.

Table 2. Main livelihood strategies of target communities in the Ayeyarwady Delta. NTFPs, non-timber forest products. (CF = community forestry).

	(A) Casual Labor	(B) Natural Resources	(C) Small Business	(D) Homegarden
Main livelihood	Casual labor	Natural resources	Small business	Homegarden (>1 ha)
Other livelihoods	Natural resources	Livestock	-	Rice farming and CF
Households (No.)	22	25	26	26
CF members	5	16	9	14
Non-CF members	17	9	17	12
Very poor	20	9	3	18
Poor	0	9	6	2
Medium	0	4	11	4
Rich	0	0	3	1
CF use	Sale and subsistence	Sale (and subsistence)	Subsistence	Sale and subsistence
CF products	NTFPs	NTFPs	NTFPs	Timber and NTFPs
	Low income	Low-middle income	Middle income	Poor-high income
Households	Men and women work as casual labor and collect	Men and women work on the farm, men tend cattle, women look after chicken and pigs	Women stay at home and look after shops, men have businesses concerned with a trade	Men work on the farm and in the forest, women are housewives or help out on the farm
Characteristics	NTFPs together			
	Landless, some farmland	Some farmland, often CF	Mostly landless	Homegarden, often CF

- Strategy A covers mainly landless households that focus on casual labor. This includes day jobs such as road construction, farm work, mangrove planting, as well as seasonal jobs on fishing boats. However, as opportunities for casual labor are often scarce, households following Strategy A often get additional income from natural resources such as forest products. Sometimes, they also do small-scale fishing or farming.
- Another strategy, Strategy B, of poorer households is to focus solely on natural resources. Most of them are members of the CFUG, and all use the CF primarily for income generation. Usually, they also have some farmland and keep livestock around their homes.
- Strategy C includes all households with a small business (e.g., shopkeepers, traders, mechanics or carpenters). These households can obtain a comparatively good income from their businesses and seldom have additional livelihood activities.
- The fourth group of households follows Strategy D. They own several hectares of homegarden with a variety of annual crops (vegetables, betel leaves) and perennials (coconut, betel nut, banana and other fruit trees), which are highly productive. The owners consume some of the produce themselves, and sell the rest at local markets. For additional income, many D households also have CF plots, which they manage actively.

Eleven households do not follow any of the main livelihood strategies described in Table 2. Some of them live from one person having full-time employment (usually as a teacher), while others rely on remittances. Some also have a mixed strategy.

Household strategies are contingent on the availability of the above-described livelihood assets. They are not linked to household size or gender balance. Households following livelihood Strategy A, B, C or D can roughly be characterized by their wealth status. Generally speaking, poorer community members often follow Strategy A or B, relying on casual labor and natural resources out of necessity,

while C households with an average-sized income were able to start a small business. D households are a bit of an exception. Although, typically, wealthier community members have homegardens, there are also numerous poor households following this strategy. This result indicates that homegardens, as well as CF and other natural resources are relevant for different groups within a community. Other particularities are reflected in the fact that the women of D, as well as C households do not commonly seek jobs outside of their homes. They are either housewives or help in the family business (including selling products from their homegardens). Shopkeepers (Strategy C) are mostly women. In poorer households, both men and women have to work in casual labor or collect forest products for sale.

In the communities, a total of 91% of households collect mangrove products. They use the CF at least partly for subsistence. Subsistence products are fuelwood, posts, poles, nypa (*Nypa fruticans*) for housing, vegetables, fish, as well as plants with medicinal properties. Both A and D households also use mangroves for income. However, while the generally wealthier D households sell timber and fuelwood, the poorer A households generate income from non-timber forest products (NTFPs). Although wealth status seems to be a key factor influencing strategic livelihood choices, other factors also play a role. One of them is the location. While in villages with direct road access, the majority of households run a small business (Strategy C), the households in more remote villages commonly rely on natural resources (Strategies A and B). Village location has a particularly significant influence on the income from CF ($p = 0.000$), whereas the two more remote villages get considerably higher contributions of CF to total income. On the other hand, migration factors showed no relation to livelihoods in this study.

3.2. Community Forestry User Groups

The community forests in the Ayeyarwady Delta follow a CF model that differs from other CF in the country. The members of the CFUGs had decided at the beginning that they wanted to have individual rather than collective ‘ownership’ for the specific plantation plots. The model includes ‘individual ownership’ and ‘collective management’. People prefer this because they have no other possibility to own private land as individuals. All land is in a demarcated reserved forest area under the Forest Department. Although the villagers have been using this land for decades, they are perceived as encroachers. Once they agree to plant mangroves on their ‘encroached land’, they can receive formal land tenure for it. Even though the CF certificate allows only for a 30-year use and does not give formal ownership, the individual CFUG members and their plots are listed at the Forest Department. After the 30-year period, the CFUG can apply for a 30-year extension. When establishing CF, all plots are demarcated and allocated to the members according to their household size and human resources. The CF members are responsible for managing their plots in terms of silvicultural practices. Often, they hire casual labor for this work. The members are promised the full benefit of the timber once the plantation is mature. Before that point, they can harvest small timber for posts and poles. All other mangrove products, including fuelwood and other NTFPs can be freely used by any other person (CF members and non-members alike). In addition, all villagers are allowed to collect mangrove seeds no matter who owns the individual plot. As a consequence, the number of forest users is much higher than the number of actively-participating CFUG members. Meanwhile, the CF area is enlarged every year with new plantations. They are open to new members. There are also former CF members, who have dropped out due to low short-term profitability and given their plots informally to other members.

According to different members of the communities, there is no conflict within the CFUG or with non-members within the villages. There are, however, occasional conflicts with people from other villages who steal small timber and fuelwood from their community forests. On the other hand, they report that since the introduction of CF, illegal logging has decreased.

CF membership and active participation are often related to availability. There is little noticeable gender dynamic to participation. According to some of the more influential CF members, poorer households are less likely to participate in the CFUGs, as they are more occupied with their daily livelihoods. Richer households, on the other hand, have more leisure time to engage in community

groups and social gatherings. This is also reflected in the fact that CF members engage in more village-level organizations (mean = 2.4, standard deviation = 2.1) than non-members (mean = 1.4, standard deviation = 1.8). However, this finding is not evidence enough for a connection between CF membership and wealth status.

3.3. Differences between CF Members and Non-Members

This study found very little difference in the wealth status of CF members and non-members based on the participatory wealth ranking, although there is a tendency that non-CF members are slightly wealthier. However, the highly congruent wealth distribution (Figure 2) shows that community forestry in the study sites is inclusive and allows all members of the communities to participate in the CFUG.

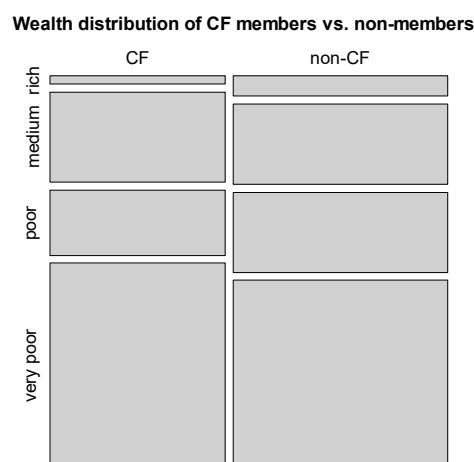


Figure 2. Wealth distribution of CF member vs. non-member households ($n = 100$).

The equal wealth distribution could also suggest that CF membership is not, or not in the short period of time since CF establishment, the only factor that can lift households out of poverty. This is partly due to the fact that poverty alleviation was not the main goal in establishing the CF, but rather a hoped-for side effect of nature restoration. Mangrove plantations are the best-known strategy to restore degraded farmlands in the area and make them not only more productive, but also more resilient. Positive effects on poverty will thus only appear in the long term. It remains to be seen whether the wealth distribution within communities will change once the mangroves are mature for timber harvesting. Currently, CF members and non-members have similar incomes.

Nevertheless, a closer look at different households' livelihood activities and forest-related benefits is necessary before a conclusion can be drawn on the relation between CF membership, wealth and subsistence and commercial use of the mangroves.

3.4. Influence of CF Membership and Wealth on Income from CF

The condition of different households seems not so different as they have similar livelihood assets, as described in Section 3.1. Some disparities are only found for social assets (community participation), part of the natural assets and, possibly, financial assets.

Livelihood strategies consist of several activities (Table 2) for both CF and non-CF households. However, this study found substantial differences between CF members and non-members concerning the contribution of different activities to total income. Not surprisingly, this is particularly visible for the collection and sale of forest products. The effect of CF membership on the contribution of CF products to total income is significant ($p = 0.004$). When adding up all income activities and their shares to the families' revenues, major differences can be detected in all major income sources except homegardens (Figure 3). While mangrove products make up the bulk of the income (36%) for CF

members, for non-members, the share is only 15%. This also indicates why the former are so willing to participate in the CFUG, while the latter have other priorities.

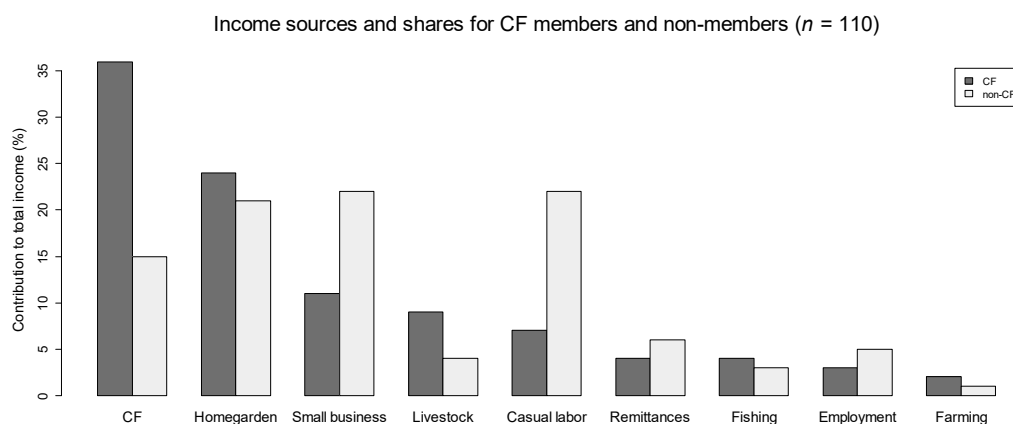


Figure 3. Income sources and shares for CF members and non-members.

According to the findings, non-members derive most of their income from small businesses, as well as casual labor and homegardens. Reliance on small businesses is in line with livelihood Strategy C, where households have few other income sources. They seldom use the community forests for commercial purposes.

It is also notable that casual labor seems to be much more pronounced in non-CF households (Figure 3). This can be partly explained by the fact that the category ‘casual labor’ includes seasonal labor for eight months. Six of the households, including one CF member household, have seasonal labor as their main income. For those getting their income from daily labor, however, non-membership in the CFUG should not be equated with non-use of CF. However, many of the interviewed people, especially the poorer ones, confirmed that they live from both daily labor and CF non-timber forest products. This strategy allows them a high degree of flexibility. When the labor market is good and well-paid jobs can be found, they choose to work as laborers. On other days, when there are limited job opportunities, they go to the mangroves to collect NTFPs. In turn, in less favorable situations, such as during low tide, they would rather work day jobs, even if they do not pay much. According to the villagers, the daily income is approximately the same, depending on the circumstances.

Significant results ($p = 0.0218$) were found regarding the influence of wealth on CF income. The contribution of mangrove CF to the incomes of different wealth groups is depicted in Table 3.

Table 3. Contribution of CF to total household income for different community groups.

	Wealth Group				
	Very Poor	Poor	Middle Income	Rich	Ø
CF members	0.47 ($n = 25$)	0.19 ($n = 8$)	0.31 ($n = 11$)	0.20 ($n = 1$)	0.38 ($n = 45$)
Non-CF members	0.21 ($n = 28$)	0.06 ($n = 12$)	0.12 ($n = 12$)	0.27 ($n = 3$)	0.16 ($n = 55$)
Mean (Ø)	0.33 ($n = 53$)	0.11 ($n = 20$)	0.21 ($n = 23$)	0.26 ($n = 4$)	0.26 ($n = 100$)

With an average income share of 33%, the poorest households rely most on the CF. Looking at the importance of CF for the poor, the potential for poverty reduction seems highly likely. Although also wealthier people get substantial income from the CF, a higher number of respondents would be needed to confirm this. With a higher income from CF, households are more likely to participate in the CFUG. This is particularly true for the very poor.

Subsistence use of mangroves, on the other hand, was reported to be important by all households. Among the various mangrove NTFPs, some are much more relevant to the local people than others. Therefore, a closer analysis of the individual products and their use was carried out.

3.5. Use of Community Forests

The study found that almost all households (91%) use wood and NTFPs from the CF area, irrespective of whether they own forest plots or not. Timber can only be used by the individual plot owners, but everyone else can collect unlimited amounts of fuelwood for subsistence and other NTFPs, so the mangroves are likely to be overused in time. From 105 responding households, 96 said that they use at least one product. On average, two types of products are collected from the CF by each household. In most cases, timber from the CF plantations cannot yet be used, as trees are too young. Most of the wood is therefore used for posts or poles and branches for fuelwood. Since all households use traditional stoves for cooking, the main product from the mangroves is fuelwood. However, out of 85 households collecting fuelwood, only 17 sell it for income generation.

The second most important product from the mangroves is the mud crab (*Scylla serrata*), which breeds at the roots of the mangroves. For most villagers who collect crabs, they have the highest priority compared to all other forest products. This is explained by the high market potential. For more than ten years, villagers have been selling crabs to traders who transport them to Yangon and further afield to China. Especially big crabs fetch a high market price of approximately 1 US\$ each. Of the 41 households catching crabs, 39 sell them to traders. Small crabs are either fattened and then sold or consumed directly by the families. It was found that the collection of crabs is an important livelihood activity across the communities, irrespective of the people's wealth status or participation in the CFUG. Another important CF product for semi-subsistence is nypa palm, in particular for poor households and women. They profit from the sale of thatched nypa for roofing. Woven nypa is locally used not only for roofing, but also for the walls of the houses. The palm sap is popular for wine production. The sweet seeds of the fruit are cherished for local consumption.

Concerning the differences in CF use by members and non-members, it was found that small timber (posts and poles) is used mostly by households who have their own plots. The reason for these different priorities is that the members can sell these items, while non-members are only permitted to use small timber for subsistence purposes. The first timber will be ready for harvesting in approximately 10–15 years. While all in all, little timber is used yet, posts and poles are important secondary sources of livelihoods. All other NTFPs have similar priorities for CF members and non-members (Figures 4 and 5). This picture is expected to change in the next decade, when trees reach a girth of 25–30 cm. Once timber is mature for harvest, it will likely become a priority for the CF households. It can be assumed that it was the main reason for them to engage in community forestry in the first place.

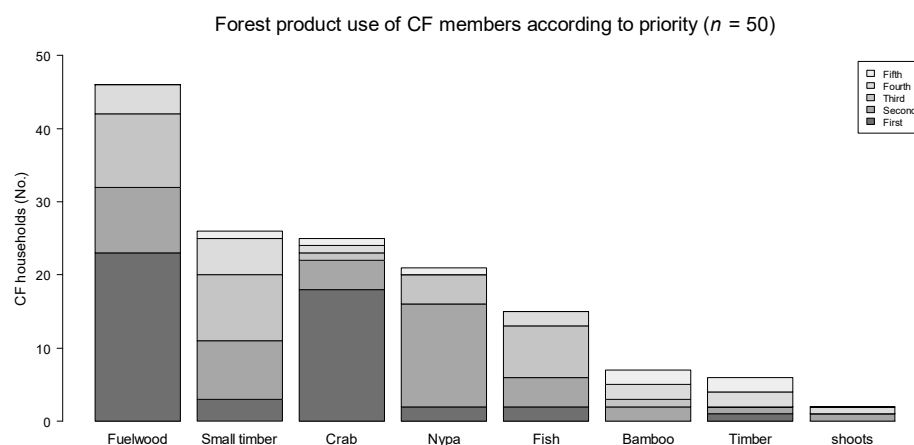


Figure 4. Use and importance of mangrove products by members of the CFUG.

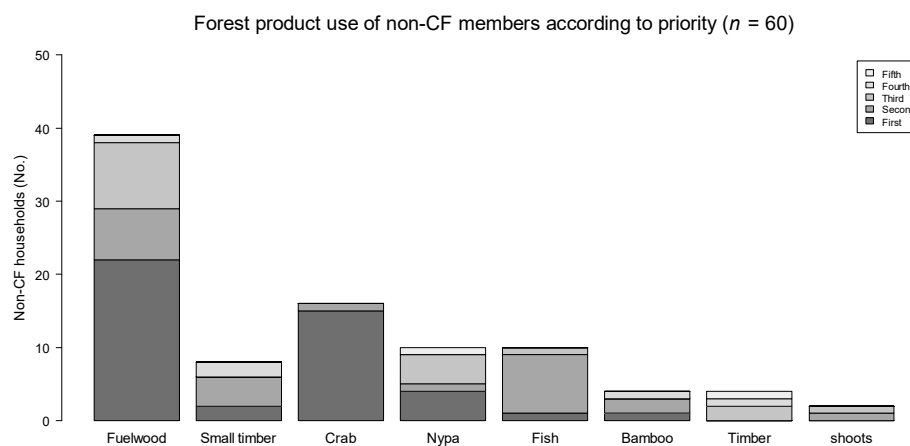


Figure 5. Use and importance of mangrove products by non-members of the CFUG.

Fuelwood is used more by CF members (92% of households) than non-members (65%, Figures 4 and 5). A possible explanation is that non-members, who go less often to the CF, prefer to take fuelwood from their homegardens. They can take fallen branches (e.g., from coconut) from other homegardens for subsistence purposes, provided that they have sought permission from the owner beforehand. Crab collection also has a higher priority among the CFUG. This could indicate that membership could possibly bring advantages for crab collectors. However, current data are not enough to confirm this argument.

In addition to the main CF products illustrated in Figures 4 and 5, minor products can be found in some of the mangrove areas and are generally used for subsistence. They include clams, snails and shrimp, as well as a type of climbing plant, which is used in a local curry dish.

Non-material goods also contribute to local livelihoods in a wider sense and improve their non-financial assets, in particular the natural assets. The community as a whole benefits from the ecosystem services provided by the established mangrove plantations. The protection they provide from storms and floods is well known. Experiences from Cyclone Nargis show that mangroves are an important safety net in the aftermath of natural disasters. After the cyclone, the forests were degraded due to overuse by the local population. They mainly used small timber to rebuild houses, fuelwood, as well as NTFPs as a source of income. For poorer households, the mangrove forests are even more important as a safety net, as they do not have many other resources to fall back on. The role of the forests as a safety net is not connected with CF membership. With Cyclone Nargis in 2008, the experience was that in times of need, the remaining resources are used by everyone. People also mentioned the cultural and spiritual value of the mangrove forests and their fauna and flora. Medicinal plants gathered in the forest can be used to treat stomach ache, fever, injuries and snake bites and thus have a positive impact on the local population's health. These examples show that CF potentially improves additional sustainable livelihood assets, such as human assets, of all people.

4. Discussion

Using case studies, this research contributes to the understanding of livelihood strategies of people living in mangrove areas, including their interaction with CF. It particularly shows their high level of reliance on the mangrove forests. Interestingly, the study reveals only small differences in the characteristics and livelihoods of households who are members of the CFUG and those who are not.

Differences in the use of CF are more attributed to income and not as much to subsistence. In terms of income, CF members get a higher share from the forest, while non-members get more from casual labor and small businesses. In the past, with expanding mangrove cover, there has been an increased collection of NTFPs for subsistence and sale for both members and non-members.

Therefore, in addition to CF membership, there are other factors that determine the livelihood strategy of a household.

4.1. Other Determinants of Livelihood Strategy Choices

As few people in the lower Ayeyarwady Delta obtain further education, livelihood strategies are mostly determined by the given circumstances such as location (i.e., remoteness) and corresponding income opportunities. Although wealth status plays a role, a substantial contribution to decisions concerning livelihood is road infrastructure in the study area. CF is much more important in those villages with no direct access to a main road. This was also found by a study in Indonesia, where improved road access led to higher economic diversity [36]. From this point, it could be argued that as infrastructure improves, CF loses its importance. However, this assumption is rather precarious. First of all, even with the possibility to start a small business, not all households are equipped or would have the desire to do so. Many of them still rely on casual labor and, as these jobs are not always available, on natural resources, with mangroves at the forefront. As time invested in livelihood activities is also believed to be an important factor, CF provides double benefits with commercial and subsistence products being collected at the same time. Secondly, non-material benefits from the mangrove forests, in particular mitigation of extreme weather events, are highly valued by the local people and also receive particular attention from outside stakeholders. Thirdly, the safety net function remains for all households, even for business owners, although to a lesser extent [37]. Inferring from this, CF will somewhat remain a priority in the livelihoods of many households, even if other opportunities arise from infrastructure development. Government investment in physical assets such as connection to the mobile phone network and electricity grid could even open the door for new markets and value-added CF products. Social factors, such as household-level decision-making and gender, have not come up as a major issue in discussions with diverse community members, and a more thorough examination would be needed to draw conclusions on their influence on livelihood strategies. However, considering that in the study area, decisions are made within households and women-led households are just as likely to be members of the CF, gender is assumed to play a lesser role than in other regions.

4.2. Impact of Community Forestry on Poor vs. Wealthy Households

The findings support the belief that a CF approach can be highly beneficial for rural communities, in particular those living in remote areas. This result also agrees with different studies, which show that environmental resources can reduce income inequality [2,38].

The majority of the interviewed households benefit directly from the CF plantations. However, while the results show a clear contribution of CF to the income and subsistence of the poor, they cannot fully confirm that CF is per se a pro-poor approach. Rather, it suggests that, at least in the study area, all households have an opportunity to profit from the community forests. Yet, it is difficult to judge whether the benefits come from the fact that they have mangrove plantations or from the fact that said plantations are under community management.

The landscape has changed dramatically in the past. Thirty years ago, mangrove forests were abundant, but mostly used for charcoal production. Fifteen years ago, deforested areas were used for rice production, but later flooded and rendered unproductive. Nowadays, mangroves are increasing again, but used for different purposes, which are mostly related to new marketing opportunities of crab. While nowadays, crabs consequently have the highest priority among the NTFPs, this was not the case a few decades ago. Timber at that time was not available to the communities, as it belonged to the government. Thus, revenues from timber, once the CF plantations are mature after 5–10 years, will possibly be the determining factor for the impact of CF on different households.

Land tenure is still an unresolved issue in many parts of Myanmar. Community forestry is one possibility for the local population to receive secured access, management and use rights over forested land for a certain time period. It can be assumed that this is one of the reasons why communities are

interested in CF. In the near future, though, the revised Community Forestry Instruction in 2016 is expected to create more commercial opportunities for the CFUGs.

4.3. Reasons for Participating in the CFUG

In order to establish CF, community members need to reach a consensus. For those households not participating in CF, the constraints are likely linked to uncertainties regarding long-term benefits. As it is, the current system of the CFUG gives minimal additional short-term benefits to its members. The main benefits, i.e., income-generation through the sale of NTFPs such as crab or nypa, are accessible to members and non-members alike. It is thus reasonable to believe that many of them do not think it a worthwhile investment, especially considering the limited income from timber in the short term. The lack of opportunities for communities making a living from timber and the deterrent of CFUG membership and forest investment is an issue in many countries in the region [39].

For those who participate in the CFUG, an assumption could be that they do so partly to receive financial gains from the sale of timber. However, this would not fully explain the high involvement of community members in some villages in the CFUG. There are also social factors connected to participation and inclusion in the decision-making processes. A factor that should not be neglected is also that the local people indeed care about the mangrove forests and are willing to invest time in proper management if they can.

Other benefits from CF participation that have not been discussed stem from the fact that it can be an opener for other foreign aid programs, and this has been an issue in some countries such as Nepal [7,40]. Oftentimes, development organizations prefer to work with village groups that are already well organized. In the study area, the core people within the CFUG also served as contact persons and were sometimes employed by international organizations working in the region. However, a more detailed analysis of the reasons for choosing to become a CF member is suggested to complement this study.

Another remaining question is whether more households (especially poorer ones) should be encouraged to participate in the CFUGs. The current livelihood situation shows no direct need for that to increase income generation opportunities, although that may change in the next decade with the harvesting of timber. An argument for the inclusion of all households would be a more coordinated use of resources. Another reason is that many CFUGs are useful platforms for information sharing, though this varies from community to community, an issue that is also found in Nepal [7]. As long as only some of the users are active members of the CFUG, there are limited opportunities to discuss a fair and sustainable yield of NTFPs from the community forests. Such arrangements are necessary to avoid future shortages of those resources and ensuing implications for the people's livelihoods.

4.4. Recommendations for Community Forestry Development

- Before establishing the CFUG, a clear communication about the benefits and the rights of members vs. non-members is necessary. This would also need to be continuously updated once the CFUG is established.
- Trust building is needed between the local communities and the government. This will make people more secure about their forest land tenure and help them make decisions in favor of a sustainable management of the CF, including investing time and money in their land.
- Regulatory rules for collecting NTFPs and timber need to be in place to guarantee long-term benefits for all users; the revised CFI will support this, but clear guidelines for its implementation are needed. More research on sustainable management of NTFPs is required to provide communities with such information.
- To decrease poverty, community forestry alone is not a solution. Additional income opportunities are required that reduce people's reliance on forests, and this needs to also consider the other livelihood assets (e.g., education, access to electricity, roads).

5. Conclusions

The study found that the livelihood strategies of the people living at the study sites in the lower Ayeyarwady Delta can be divided into four main groups. The four strategies according to the corresponding main activity are: (A) casual labor; (B) natural resources; (C) small business; (D) homegarden. The key determinants of which strategy a household follows are road access and job opportunities, human assets and land availability. The poorer households usually follow Strategies A, B and D, while the wealthier tend to follow C and D. Although income generation and subsistence use of CF products differ within these strategies, a total of 91% of all households use the CF in one way or another.

The CFUGs' members have their own plots within the forest area. They decide on the mangrove species and manage the plantations for a period of 30 years. When trees are mature, they will benefit from the sale of the timber, with this potentially being more significant with the more favorable regulatory environment through the recently revised CFI. All other villagers, members and non-members alike are allowed to use non-timber forest products for subsistence and commercial purposes. The most important products are fuelwood for subsistence and mud crab and nypa palm for sale.

While CF-members and non-members have similar livelihood activities, CF members get most income from the CF (on average 36%) and non-members from small business, casual labor and homegardens. Additionally, this study found high effects of CF membership ($p = 0.004$) and wealth ($p = 0.0218$) on the contribution of CF products to total income. With an average share of 33%, the poorest households depend most on the mangrove CF. Non-monetary benefits such as the mangroves' function as a safety net were experienced to be more substantial for poor households in the past, due to a limited availability of other, mainly financial, assets. In conclusion, this study pointed out that while CF is important for the majority of community members, there are considerable differences concerning its use and revenues depending on the CF membership and wealth status of a household. Inclusiveness of different community groups in the CFUG and widespread use of NTFPs for income and subsistence in the study area demonstrate that CF has the potential to greatly reduce poverty.

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